North Coast LRMP

Background Report

An introduction to adaptive management

Prepared by

Brenda Taylor

October 2000

BRITISH COLUMBIA

106-02187/

This report was prepared by independent consultant, Brenda Taylor, as background information on adaptive management in the North Coast LRMP area. The information in this report was collected from a wide range of sources and was reviewed by government staff for accuracy and completeness. The final product is presented as the professional judgement of the authors and does not necessarily reflect the view of the Province.

Table of Contents

1.0 Introduction 1

2.0 LRMPs: defining a pathway for the future 2

3.0 Conclusion 6

4.0 Further reading 9

1.0 Introduction

> *"One must learn by doing; for though you think you know it, you have no certainty until you try." Sophocles (ca. 450 BC)*

It is easy to look back with humour or scorn at what was done in the past, but it is important to keep in mind that all of our decision-making through the ages has been, for the most part, based on the best information available at the time and carried out with good intentions. This is as true for management of land and resources as for other social, economic and environmental decisions. We are part of a process of evolution of thought and understanding. By acknowledging that we don't have all the answers, we can plan to learn from our actions and provide future decision-makers with valuable information to continually improve management of resources.

2.0 LRMPs: defining a pathway for the future

LRMPs provide strategic direction (through zoning, objectives and strategies) in order to achieve a number of long-term goals for Crown land and resources. They define what we want the landbase to look like ten, fifty or one hundred years from now and they provide direction on how to go about getting there. The challenge that LRMP participants face is how to make these decisions when we only partially understand what the impacts might be.

Uncertainty is unavoidable

Ecological and social systems are complex, dynamic and inherently unpredictable. This means that ***uncertainty*** is an inevitable part of resource management. It can be extremely difficult to predict what will happen if we follow a certain pathway, which of several possible pathways will lead us to our goal, or what the tradeoffs are with each pathway. Developing an LRMP is particularly challenging because we are dealing with a large landbase, multiple objectives (values), and a wide variety of management activities. It can be difficult to "see" what will happen with different scenarios.

Choosing a pathway in the face of uncertainty

What are our options for choosing a pathway in the face of this uncertainty?

1. *Ignore it.* Base decisions on the best information available and assume that those decisions are correct. This approach can lead to outcomes that are less than optimal and in some cases disastrous. It is particularly dangerous when there is little or no monitoring of actual responses. You may not realise that the strategy "didn't work" until it is too late to correct it. The collapse of the Northern Cod stocks is an example of the disastrous consequences of ignoring uncertainty.
2. *Postpone decisions until we have more information.* Postponing decisions can have economic, social and ecological costs (e.g., carrying on with the conventional harvesting may have ecological costs; deferring areas from harvesting may have social and economic costs). Also, proof of the need for change may be impossible to get or may come too late. For example, some argue that we should delay action on reducing greenhouse gases until we have "proof" that global warming is occurring. Unfortunately, by then it will take much longer to correct the problem, and we will have to live with potentially severe and expensive consequences of inaction.
3. *Assume the worst.* Make decisions assuming that the worst case scenario is true. Be over-cautious. This may lead to strategies that are "unnecessarily restrictive".
4. *Assume the best.* Make decisions assuming that the best case scenario is true. This may lead to strategies that are "overly lenient".
5. *Learn by doing.* Deliberately design plans themselves to resolve key uncertainties, to learn what works, what doesn't and why. In making decisions, take uncertainty into account explicitly, e.g., by using techniques that rank options based not only on the *value* of their potential outcomes, but also the *probability* of those outcomes.

Learning by doing

There is a continuum of approaches to learning by doing (*Figure 1*). In general, more rigorous and systematic approaches result in more efficient learning. At one end of the continuum is trial-and-error: we try something, see if it works and change if it doesn't. Learning through trial and error tends to be haphazard and inefficient (especially for complex problems). There is little or no assessment of existing information, exploration of different options, or monitoring of outcomes. Assessment of whether a strategy "worked" or not may be based simply on casual observation.

Figure 1: Continuum of approaches to learning

Further along the continuum is the approach used in most LRMPs, where several possible courses of action are explored, with one being chosen and implemented. A monitoring strategy is developed to assess the effectiveness of the chosen course of action, and management is adjusted if/when necessary (based on information from monitoring). Some refer to this as "passive adaptive management".

Even further along the continuum, management plans themselves are deliberately designed to fill key information gaps, to tell us not only *whether* something worked, but also *why* it worked. Such information can lead to better management in the long term. Some refer to this as "active adaptive management".

Adaptive management: a pro-active approach

Adaptive management is a pro-active approach to managing in the face of uncertainty. (*see Box: Dealing with uncertainty: adaptive management vs. the precautionary approach*). It is "...a systematic, rigorous approach for learning from our actions, improving management and accommodating change" (B.C. Ministry of Forests brochure). Adaptive management is more than simply adjusting or adapting in *response* to new information. In adaptive management, plans themselves are designed to actively *generate* information and "build a legacy of knowledge".

In conventional management, we try to decide upfront "which action is best" (a futile and frustrating exercise when information and understanding are limited); in adaptive management we design plans to *reveal* which action is best. At a minimum, plans and monitoring strategies are carefully designed so that they will provide reliable feedback about whether or not a strategy "worked". Even better, management plans are designed to compare several options in the "real world", in order to reveal which strategy is better and *why*.

Dealing with uncertainty: adaptive management vs. the precautionary approach

We cannot get rid of uncertainty. Nor can we just throw up our hands and walk away (evasion is also a "decision" that has costs associated with it). Adaptive management and the precautionary principle are two alternatives for dealing with uncertainty. Adaptive management seeks to learn from actions themselves. The precautionary principle essentially "assumes the worst", recommending a strategy that errs on the side of caution, where the likelihood of undesirable impacts are minimized. These two approaches are appropriate in different situations.

The **precautionary principle** makes sense where:

- the consequences of a particular outcome are irreversible and unacceptable (e.g., for a particular endangered species or stock, any level of harvesting may be unacceptable because the risk of pushing it to extinction are simply too high);

- it is impossible or impractical to design an informative strategy that will resolve key uncertainties. This may be the case where we are dealing with a single, unique system or very long response times (e.g. global warming), or indicators with high levels of natural variability or measurement error (e.g. populations of blue whales).

It works best where there is general agreement that the risk of a particular outcome is simply too high *and* where one of the proposed strategies is much less likely than the others to lead to that outcome. The disadvantages of the precautionary approach are that it may be unnecessarily restrictive (and costly) and it does nothing to resolve outstanding uncertainties and the roadblocks they create. You may miss opportunities for better outcomes.

Adaptive management makes sense where:

- no one strategy is substantially better than the others;
- it is possible, practical and acceptable to resolve key uncertainties and resolving these uncertainties would reveal a strategy with a better outcome.

It can be tempting, when working with incomplete information, to put off difficult decisions "until more information is available" (e.g., better inventories or more up-to-date research results). Keep in mind, though, that delaying decisions often has a cost, and that cost may be as high as proceeding with incomplete information. Even decisions that are seemingly benign or precautionary may turn out to have unintended or unforeseen consequences. The precautionary approach won't guarantee that an undesirable outcome is avoided.

Why use adaptive management?

Uncertainty is an unavoidable part of developing an LRMP and managing resources. Ignoring uncertainty can have social, economic and ecological costs: we may implement actions that turn out to be unnecessarily restrictive, overly lenient or ineffective and we may miss opportunities for better management. Learning through trial-and-error is often haphazard and inefficient (particularly for complex problems). Results are easily misinterpreted because there may be a number of possible reasons for an observed change (e.g., are salmon runs decreasing because of habitat loss, changing ocean conditions, overfishing or a combination of all three? Or is the decrease simply due to natural variation?).

Adaptive management is a more efficient way of learning by doing. First, a carefully designed management plan and monitoring strategy will yield feedback that is more reliable than simple observation. Second, testing several options against one another will reveal the "best" option more quickly than trying one option after another. Third, adaptive management can help us understand why something did or did not work. By understanding *why* a strategy did or did not work (which really means understanding more about the system we are managing), we then have a better idea not only *if* to adjust actions, but also *how* to adjust them. (*see Box: Understanding* ***why)***. We are also better equipped to adjust to changing conditions (e.g., global warming) and values.

Applying adaptive management

Adaptive management is a way of thinking, an approach to management where uncertainty is acknowledged and learning is valued. The steps then flow out of this way of thinking. For example, simply by acknowledging uncertainty, by stating that we do not know what the right answer is, we also acknowledge that there may be a number of alternative management strategies to explore. By identifying key uncertainties, we begin to look for opportunities to resolve them. Monitoring becomes an integral part of the plan; evaluation and adjustment are built into the plan from the outset. The key to implementing adaptive management is to ask ourselves:

- how can we learn from what we are about to do?
- how can we get reliable feedback about whether this strategy "worked" and if so, why?

The six basic steps in the adaptive management cycle (*see Box: The Adaptive management framework*) overlap with a number of the phases and steps in strategic land use planning. For example, both adaptive management and LRMPs involve documenting goals, defining indicators, evaluating scenarios, monitoring progress towards goals, and reviewing and amending plans. Applying adaptive management to the LRMP means shifting from trying to identify the "best" strategy upfront to designing plans that will reveal the best strategy. This involves implementing and comparing several alternative strategies in the "real world". In doing this we are saying "we don't know what the right answer is, but this is how we are going to find out". Once we have carefully compared the outcomes of these alternative strategies, we can then adjust the LRMP and lower level plans to reflect this new knowledge.

Understanding Why

Simply knowing that an action didn't work isn't very useful. You are left wondering what to try next, how to change. By understanding why an action did or did not work, we will better understand how (or if) to adjust it, whether to apply it to other areas, and how to adjust it if conditions or objectives change.

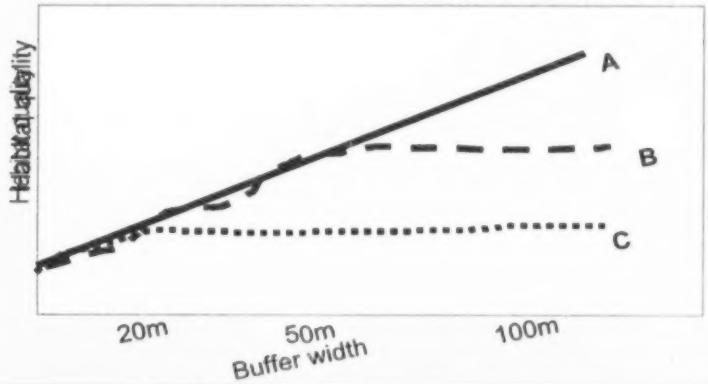
Example 1: Artificial spawning channels

Artificial spawning channels were built on the Skeena River in an effort to increase runs of sockeye salmon. Initially, there was little change in the number of returning adults, but 20 years later, runs have increased. Are the spawning channels effective? Should they be built on more rivers? The answer is unclear. Similar increases in other rivers (where spawning channels were not built) suggest that other factors may be at work (e.g., natural variation, reduced fishing pressure, better ocean survival etc.). There is really no way of knowing whether returns would have increased without the spawning channels. This design could have been improved by monitoring returns on a similar river system where no spawning channels were built.

Example 2: Tailed frogs

Initial experimental evidence suggests that maintaining a riparian buffer along those reaches of streams that contain tailed frogs can reduce the impacts of harvesting on tadpole abundance. ***If the planning table decides to recommend an increased buffer along tailed frog streams, what size of buffer should they choose?*** Disagreement or uncertainty about which buffer width will best meet objectives may arise from different views (assumptions) about the way the ecosystem works. For example, one person (A) might assume that as riparian buffer width increases, habitat quality for tailed frogs increases. This might lead them to argue that a 100 m buffer is better than a 50 m buffer. A second person (B) might assume that beyond 50 m, further increases in buffer width do not improve habitat quality. They might argue that a 50 m buffer is as good as a 100m buffer and will have less impact on timber supply. A third person (C) might argue that improvements in habitat quality level off at 20m, not at 50 m.

These three different views of the relationship between habitat quality and buffer width are represented by the 3 different lines (A, B, C) in the figure below. How does the planning table choose a strategy that is "right" (i.e., best reflects the "true" relationship between buffer width and habitat quality)? Using adaptive management, the LRMP could recommend that lower level planning include a comparison of several different buffer widths, in order to test which assumption is right. Once we have determined which assumption is correct (and thus which width best meets objectives for habitat quality, as well as other values), the "best" width can be applied on other similar sites. In addition, if values change in the future, we will have a better understanding of how to the alter buffer width to reflect those changes.



The Adaptive Management Framework

Adaptive management involves a basic framework of 6 steps. These steps are common to all problems, although the details of how they are applied will depend on the characteristics of the problem and the creativity of the participants.

Step 1 Assess: Define the problem. Define measurable management objectives and indicators. Explore the effects of alternative strategies. Document predicted outcomes. Identify key uncertainties and assumptions. Document the basis for decisions.

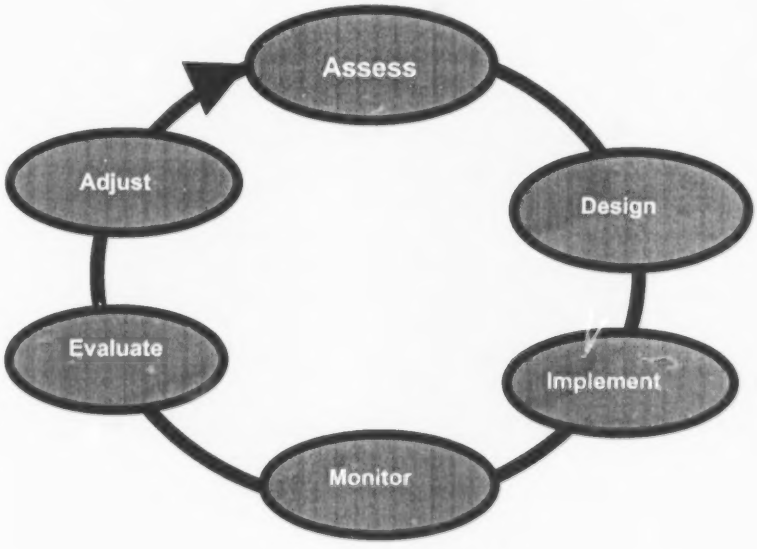
Step 2 Design: Ask yourself "how can we learn from what we are about to do?". Design a management plan to test key assumptions/resolve key uncertainties (apply the principles of experimental design to design of management actions). Define details of monitoring plan.

Step 3 Implement: Follow the plan. Document deviations from the plan.

Step 4 Monitor: Monitor implementation and effectiveness, according to the plan.

Step 5 Evaluate: Compare actual outcomes to predicted outcomes. Assess which assumption is supported by data. Document and communicate results.

Step 6 Adjust: Close the loop! Revise assumptions as necessary. Update models (mental models and computer models). Confirm or adjust management actions/strategies. Identify further uncertainties that should be resolved.



3.0 Conclusion

Uncertainty is an unavoidable part of strategic land use planning. The challenge is to make informed decisions in the face of that uncertainty and to learn from the outcomes of those decisions. Adaptive management is a rigorous and systematic way of learning by doing. Rather than ignoring uncertainty, those with an "adaptive management attitude" say "right, we are not certain about the outcome or about which is the best strategy, but here is how we are going to find out". It is a pro-active approach to dealing with uncertainty, where management plans are designed to meet management objectives *and* resolve key uncertainties.

Used wisely, adaptive management can help you to address some of the challenges presented in strategic land use planning, but it is not a panacea. It can resolve disagreements over how to reach a desired future condition, but it cannot resolve disagreements over values or what the desired future condition should be. Adaptive management is like a compass: once your destination is defined, it can help you find your way there, even when the pathway is obscured by uncertainty and complexity.

4.0 Further reading

B.C. Ministry of Forests. Adaptive Management: learning from our forests (4pp. brochure)

Lee, K.N. 1993. Compass and gyroscope: integrating science and politics for the environment. Island Press, Washington, D.C.

Sit, V. and B. Taylor (editors). 1998. Statistical Methods for Adaptive Management Studies. Research Branch, BC Ministry of Forests, Victoria, B.C. Land Management Handbook No. 42

Taylor, B., L. Kremsater and R. Ellis. 1997. Adaptive Management of Forests in British Columbia. B.C. Ministry of Forests.

Walters, C.J. 1986. Adaptive management of renewable resources. McGraw-Hill, New York, N.Y.